Gyroharmonic features of ASSI generation

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In experiments [Ponomarenko et al., 1999] it has been revealed that for pump wave (PW) frequency slightly exceeding the 4th gyroharmonic frequency significant spectral broadening (up to 5 – 10 Hz) of signals scattered from artificial field-aligned decameter irregularities is observed. The explanation of this effect has been given in [Gurevich and Zybin, 2006] basing on the generation of intensive artificial supra-small-scale irregularities of the plasma density (ASSI) with $l_\perp \approx 10 – 20$ cm. In the report new results of the study of ASSI features are presented.

In experiments [Frolov et al., 2012] it has been found that: 1) the largest spectral broadening is observed in the “magnetic zenith” region for the PW, where the generation of the most intensive artificial small-scale irregularities takes place, and when the PW frequency offset from the gyroharmonic is $\delta f_m = f_0 - 4f_{ce} \approx 20 – 60$ kHz, exactly where the generation of the most intensive BUM emission component is observed; 2) the broadband component of scattered signals develops together with decameter irregularities; 3) the typical time of broadband component relaxation is about of 0.4 – 0.9 s, during which a decrease in the intensity of this component is determined by a rapid narrowing of the received signal spectrum at a rate of 1 Hz for 0.2 – 0.3 s.

Detection of ASSI in experiments at the Sura facility has been made by means of ionosphere sounding using GPS signals [Frolov et al., 2012,2017]. Data obtained allow to conclude that, when the PW is switch-on, variations in STEC by 0.02–0.03 TECU (1 TECU = 10^{16} el/m^2) have been observed. These data permit one to estimate: 1) the typical time of increase in STEC variations as 2 – 5 s which coincides with the typical rise time of decameter irregularities; 2) the typical time of decay of STEC variations, which does not exceed 1 s and is much less than the relaxation time of decameter irregularities corresponding to the relaxation time of the broadband scattered component discussed above; 3) ASSI plasma density variations $\Delta N/N$, which has to be of about 2 – 3%.

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